Wildlife-Highway Crossing Mitigation Measures and Associated Costs/Benefits: a Toolbox for Montana Department of Transportation

(MPART project)

by

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TABLE OF CONTENTS

BACKGROUND AND PROBLEM STATEMENT

Reducing animal-vehicle collisions and improving habitat connectivity for wildlife across roadways are important factors to consider in highway construction or improvement projects for human safety, economical, and ecological reasons.   The estimated 725,000 to 1,500,000 collisions between motor vehicles and wildlife result in more than 200 human fatalities, 29,000 human injuries, and over 1 billion dollars in property damage in the United States alone each year (Conover et al. 1995, Romin and Bissonette 1996). Wildlife-vehicle collisions (WVCs) are a significant source of mortality to many species, with millions of individuals from a wide array of species killed each year (Evink 2002, Iuell et al. 2003, Forman et al. 2003). In addition, highways can be a movement barrier to many species, causing habitat fragmentation and, sometimes, reduced survival probability for the population concerned (Clevenger et al. 2002, Forman et al. 2003, Mills and Conrey 2003, Foresman 2004).

Engineers and biologists have tested a variety of potential solutions to the safety, economical and ecological conflicts between wildlife and highways. Many years of work have now resulted in substantial knowledge about the application and effectiveness of a wide array of mitigation measures that have been deployed worldwide to solve situation-specific wildlife crossing concerns (e.g. Iuell et al. 2003, Knapp et al. 2004). However, knowing which mitigation measure addresses a particular problem, and which would be suitable given local circumstances, can be challenging.

The Montana Department of Transportation (MDT) asked the Western Transportation Institute at Montana State University (WTI-MSU) (MPART project) to submit a proposal to provide an overview of mitigation measures that reduce animal-vehicle collisions and allow animals to cross the road safely. MDT requested that the overview be restricted to mitigation measures aimed at large terrestrial mammals (deer size and larger). Furthermore, each mitigation measure should not only be described in general terms, but each measure should be evaluated for its pros and cons regarding its effectiveness in increasing safety and habitat connectivity, its appropriate use and restrictions, construction costs, and maintenance costs.

TECHNICAL APPROACH

WTI-MSU will provide an overview of mitigation measures that reduce animal-vehicle collisions and that provide habitat connectivity for wildlife. The overview will be restricted to mitigation measures aimed at large terrestrial mammals (deer size and larger). The overview will aid MDT with the decision-making process regarding the choice and placement of mitigation structures for current and future projects.

The report will list mitigation measures in use (or in planning) throughout North America, Europe, and elsewhere in the world.

Three broad-scale categories of mitigation measures will be detailed:

- Measures that aim to modify traffic and/or driver behavior (e.g., traffic volume, speed reduction, warning signs (including animal detection systems), methods to increase visibility, and education/outreach).

- Measures that aim to modify animal behavior and that do not require substantial structures or equipment on or along the road (e.g., deer whistles, ungulate repellants, population reduction, hazing, and vegetation alteration).

- Measures that aim to modify animal behavior and that require more substantial structures or equipment on or along the road (e.g., reflectors/mirrors, fencing, and multiple wildlife crossing structure designs).

The report will detail an estimated total of 30 mitigation measures belonging to these three categories. Our list will only include mitigation measures aimed at reducing animal-vehicle collisions and providing habitat connectivity for wildlife. In addition, the report will include only those mitigation measures that are relevant to roads and highways (i.e., no mitigation measures that (only) relate to waterways or railways). Furthermore, only mitigation measures pertaining to large terrestrial mammals that are a safety hazard to humans in North America (deer size and larger) will be considered. However, this report will also include information regarding how such measures may affect or benefit other species, such as threatened and endangered species (regardless of their size), amphibians, and/or small mammals.

For each mitigation measure, the report will list:

- A general description of the measure, including materials for construction, implementation, and/or maintenance, as well as design guidelines and a range of usable dimensions for structural solutions.

- Color photographs depicting the mitigation measure (only if photographs are readily available at no cost).

- The problem addressed by the measure, including a list of target species if applicable.

- Case studies and real-world examples of the tool in use, including color pictures where possible.

- Information on the effectiveness of each measure (safety and habitat connectivity), and variables influencing effectiveness

- The range of costs for construction or installation of the mitigation measure.

- The range of costs for maintenance of the mitigation measure.

- The pros and cons of each mitigation measure, including its limitations, effects on non-target species (positive or negative), how local circumstances can enhance or negate the effects of each measure and a cost-benefit summary in terms of human safety and habitat connectivity given the economic input for construction and maintenance.

- A classification of the utility of the measure. Classifications will be based off Knapp et al. (2004) and will include: 1) use with positive results, 2) use with conflicting results, 3) use with negative results, 4) use but little/no study, and 5) little/no use and little/no study.

The report will include a decision support tool in the form of a summary table that provides at-a-glance information about the cost and effectiveness of each mitigation measure similar to Iuell et al. (2003). This table will provide comparative construction and maintenance cost information for each mitigation structure, and will use codes to compare each mitigation measure for safety (collision reduction) and habitat connectivity for target species (e.g., deer, elk, moose, black bear, grizzly bear, mountain lion and wolf) and non-target species (e.g., including small mammals and amphibians). Codes will indicate whether a specific mitigation measure provides an optimal solution, a usable solution with adaptation, an unsuitable solution, or whether results are unknown for each species. This table will provide at-a-glance information for managers regarding the potential costs and benefits of each crossing structure, as well as warning managers of potential adverse impacts on other species.

Literature sources reviewed will include: peer reviewed journal articles, proceedings, manuscripts, books and synthesis documents, such as Irby and Podruzny (2001), the NCHRP synthesis (Evink 2002), the COST 341 guide (Iuell et al. 2003), Foreman et al. (2003), and the deer-vehicle crash toolbox (Knapp et al. 2004).

Furthermore WTI-MSU proposes to consult with our regional, national and international network of policy makers and researchers, and construction and maintenance specialists involved with mitigation measures aimed at large terrestrial mammals (deer size and larger). We expect that these experts will provide valuable information, especially with regard to construction, installation and maintenance costs.

BENEFITS

This document will have several benefits to MDT.   The manual will be accessible and understandable to engineers, highway planners and wildlife managers, and will provide them with the latest information regarding the selection, effectiveness, costs, construction, and maintenance of mitigation structures and how local circumstances may influence decisions. The manual will emphasize a context-sensitive approach given existing infrastructure, surrounding land uses, and ecological concerns. It will provide information to help MDT determine where they can realistically implement specific mitigation measures to balance initial and maintenance costs with the perceived ecological and safety benefits of each tool.

DELIVERABLES

The first deliverable will be a draft report, similar in format to Huijser et al. (2006), which will synthesize information from existing literature, literature reviews, and expert interviews. The report will list mitigation measures that are used to reduce animal-vehicle collisions and that allow for animals to cross the road. The overview will be restricted to mitigation measures aimed at large terrestrial mammals (deer size and up). Furthermore, the report will include only those mitigation measures relevant to roads and highways (i.e., not to waterways or railways). For each mitigation measure the report will list a general description of the measure, the problem addressed by the measure, case studies and real-world examples of the tool in use, information on the effectiveness of each measure (safety and habitat connectivity), the range of costs for construction, installation and maintenance of the mitigation measure, the pros and cons of each mitigation measure, and a classification of the measure based on its use and effectiveness. The draft and final report will be delivered in MS Word and PDF format only. Furthermore, WTI-MSU will present the results of the project in person to MDT management staff in Helena through a power point presentation.

Limitations: The report will only include information that is readily available from the literature or from expert interviews. No field research or raw data analyses will be conducted. This work will only review existing information.

SCHEDULE

The draft documents are due to MDT by December 31st, 2006 (see below). The schedule allows a review period of two months for MDT. Based on the comments provided, WTI staff will address comments and deliver a final version to MDT by March 31st 2007. The final report will be delivered as an e-file in MS Word and PDF format only.

Tasks	October 2006 through March 2007					
	October	November	December	January	February	March
Task 1: Draft Report Preparation	██	██	██			
Task 2: MDT Review of Draft				██	██	
Task 3: WTI Final Report Preparation						██

STAFFING

Marcel Huijser, PhD. Research Ecologist

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PROJECT BUDGET

This is a MPART project that requires matching funds from WTI (20% of the total costs for MPART projects < $ 25,000).

Budget	Total Hours/ Total Labor Costs	Other Direct Expenses			Totals
		Travel	Communications	Printing	Total Costs
Task # Task Title					
1 Literature Review and Interviews	325 $8,303.35	$ -	$ 200.00	$ -	$8,503.35
2 Completing Draft Document	140 $3,629.00				$3,629.00
3 Addressing Comments and Final Report	170 $4,254.50	$ 170.00	$ 50.00		$4,474.50
TOTAL HOURS **TOTAL DIRECT COSTS (includes ben.)**	635 $16,186.85	$ 170.00	$ 250.00	$ -	$16,606.85
Indirect Costs at 20%	$3,237.37	$34.00	$50.00	$0.00	$3,321.37
Total Project Costs	$19,424.22	$ 204.00	$ 300.00	$ -	$19,928.22

MPART project < $ 25,000	
Contribution MDT (80%)	$15,942.58
Contribution WTI (20%)	$3,985.64
Total	$19,928.22

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